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Electricity in Facial Blemishes.

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ELECTRICITY

AND THE

METHODS OF ITS EMPLOYMENT IN REMOVING SUPERFLUOUS HAIR AND OTHER FACIAL BLEMISHES.

BY

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PREFACE.

The employment of electrolysis for the removal of superfluous hair has stood the test of not less than thirteen years by the profession, and the verdict is that it has come to stay. I well remember the unfriendly criticism of some members of the medical profession who had less knowledge of the physics and therapeutics of electricity than of some other branch of the medical sciences. That time of criticism has passed away, and the success of the operation depends upon the skill of the operator. So many have proven the competency of the process that if a failure is recorded the operator and not the method is to be blamed.

This monograph has been written with the idea of answering the many questions asked by brother physicians relative to this subject, and of furnishing instruction to those who desire to become proficient in this operation.

During the ten years I have employed electricity in the removal of superfluous hair I

have met with cases of all grades of difficulty, and have drawn from my past experience in describing the various modifications of the operation to meet the numerous difficulties to be overcome. My aim has been to present the subject in such a manner that any physician attempting this operation, no matter how difficult the case may be, need not fail of success.

Closely related to superfluous hairs are nævi and other facial blemishes, in the removal of which electricity in some of its modifications serves as a principal or an adjuvant. For this reason a chapter has been devoted to their consideration.

For the better understanding of some of the difficulties to be encountered a chapter on the histology of the skin and hair has been introduced. The illustrations of this chapter have been reproduced from drawings from microscopical preparations in my possession. These drawings were made by my student, Mr. F. A. Knights, to whom my warmest thanks are given for his valuable assistance.

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Electricity and the Methods of Its Employment In Removing Superfluous Hair and Other Facial Blemishes.

CHAPTER I.

THE STATEMENT OF THE CASE.

To Remove the hair from the surface of the body, where the growth is a blemish or produces inconvenience or pain.

One of the factors of the case is that the hair chemically is of the same composition as is the surface of the skin. The hair shaft consists of epithelial cells which are fixed and undergo no further change except as they may be worn away by external causes.

The application of any chemical which will penetrate deeply enough to destroy the hair papilla must of necessity destroy the skin as well. That such is the fact is attested by the results obtained in numerous cases in which some caustic has been used. The hair in some of these cases had been destroyed, and

the skin as well, as is evinced by an unsightly scar. In some of these cases hair growing through the scar records a failure of the main object.

THE MEANS OF ACCOMPLISHMENT—ELECTROLYSIS.

Without entering into the theory of electrolysis, all we need to understand is that the galvanic current is the only one to be employed; and that at the negative pole (from the zinc plate of the battery) hydrogen gas and caustic soda and potassa are formed; at the positive pole (that obtained from the carbon or copper plate) oxygen, chlorine and the acid radicals of the inorganic acids appear. The amount of these substances which appears depends upon the strength of the current (ampereage) and the length of time the current is allowed to pass. The effect of the current may be limited to an almost microscopical point, and it may be carried to any depth beneath the surface of the skin. It is thus seen that we have at our command an acid or alkaline caustic which we can liberate

rapidly or slowly, in any desired quantity, and which we can apply at any desired point, and can thus control its activity in a manner impossible of accomplishment by any other means.

If now we should attach to the negative pole a thin piece of metal, which is introduced by the side of a hair and carried into the tissues so that it reaches a point near the hair papilla, and then complete the circuit of electricity, liberation of hydrogen and alkalies will take place, and destruction of the tissues will result around the needle. If we have been fortunate enough to get into close proximity with the papilla, the tissue composing it will be destroyed and the hair will never be reproduced.

If in place of having the needle connected with the negative pole it had been connected with the positive pole, and a metal used which is not acted upon by the elements and acids separated at this pole, a similar result would have been accomplished.

In the first instance the cauterization

would have been by means of the alkalies; in the second by means of the acids.

The delicacy of the needle and the necessity of having it retain (to a considerable extent) firmness and rigidity, makes it impossible to insulate it between its point and the portion connected with the holder. In consequence of this inability to insulate the needle, electrolysis will take place along the whole of the shaft of the needle from the surface of the skin to the point. This solution of continuity must and does result in every instance. Certain portions of the tissues are destroyed, and cicatricial tissue will take the place of the destroyed tissues. A scar, though ordinarily a minute one, must of necessity be produced. In a cosmetic sense a visible scar does not result in the majority of cases. That these small and almost microscopic scars are always produced, I have repeatedly demonstrated by placing the patient in a strong light, and either irritating the skin to cause redness around the cicatricial point, or putting it upon the stretch.

Given, then, a hairy growth upon the face, or elsewhere, its removal can be accomplished by means of electrolysis (cauterization by an alkaline or an acid caustic).

The problem remaining is how to accomplish this result without disfigurement; for while patients will tell you that they do not care how much of a scar remains so that they can get the offending hairs out of the way, yet when they come into possession of scars they have many times repented of their statements and would have willingly taken back the hairs, for these could have been cut off or pulled out.

Soon after I began the use of electricity for this purpose I found out that to make a success of every case required a knowledge of the histology of the skin and hair such as I was not able at that time to find in reference books. I also found that I had to vary the strength of the current to suit the different cases, to alter the size and shape of the needle used, to change the application of the current according to certain idiosyncrasies

of the patient, and to use some definite form of treatment in overcoming the lesion produced. The following chapters will take up in detail the points above mentioned.

CHAPTER II.

HISTOLOGY OF THE SKIN AND HAIR.

While the histology of the skin and hair is comparatively well known, I find that there are many variations from the typical hair growth as is figured in our works on anatomy and histology. In some of the cases the variation is so gross that the microscope need not be called into requisition in demonstrating the fact.

Each case has a hair growth peculiar to itself, and can be classed with certain other cases which it closely resembles.

The difference in histology of these hair growths requires a difference in treatment, so that a process which is perfectly successful in one case would be almost a total failure in another in which the anatomical relations were different. For these reasons I have introduced this chapter, in which I have placed on record some of my own observations, and

have illustrated the facts by microscopical drawings of sections which I have prepared.

Before proceeding with my own observations on the histology of the hair, let us hurriedly review the histology of the skin and hair as found in our text-books, with especial stress laid on two or three points as explanatory of certain effects produced when electrolysis takes place.

THE SKIN.

Proceeding from the surface inwards we find the first layer, the epidermis, which may be further divided into:

1. The horny layer, composed of cells without protoplasm, and apparently without a nucleus, very much flattened and cemented together.

2. Immediately beneath this layer is the Malpighian layer, composed of nucleated cells, more or less spheroidal in form and some of them presenting a notched or serrated appearance, the so-called prickle cells.

3. Immediately beneath this layer, and

forming the second portion of the Malpighian layer, is a row of columnar cells placed perpendicularly to the tissue beneath, and having no distinct cell membrane. Beneath this is the dermis, which consists of two layers.

a. A thin layer of imperfectly differentiated connective tissue. The upper portion of this forms a kind of basement or limiting membrane, on which the columnar epidermic cells of the deeper Malpighian cells rest.

b. This connective tissue becomes a fine mesh-work and as we go deeper becomes coarser until it merges into the connective tissue mesh-work containing fat cells. The dermis is considered to cease where the fat cells begin to make their appearance.

Situated in the dermis may be found the nerve fibers, touch-corpuscles, and the capillaries of the skin; all of which may be found terminating or turning upon themselves in loops in the papillæ.

The thickness of the skin varies from one-eighth to one-tenth inch (3.3 to 2.7 mm).

Before taking up the hair structure, let us

for a few minutes examine the structure of the skin in reference to its electrical conductivity.

These layers that we have already considered are pierced, as you well know, by innumerable pores, through which the sebaceous follicles and sweat glands open, and the hair shaft passes.

The outer or horny layer of the skin is well named, and is said to contain less water than does the enamel of the teeth; in fact it is the driest of all the animal tissues, thus forming a physiological insulator. It is, in this dry state, an almost perfect non-conductor of electricity, but it is so thin that a current of comparative low voltage is sufficient to overcome its resistance. If a dry metallic electrode, or the dry hand of the operator, used as an electrode, be carried lightly over the surface of the dry skin of the face, and a current of faradic electricity conveyed to the subject, a crackling noise will be heard, due to the passage of minute sparks of electricity through this horny layer into the more

moist and consequently better conducting tissues beneath. If the skin is moistened, or remains in contact with a moistened electrode, it soon loses this exceeding dryness, and becomes a much better conductor of electricity. At the same time the moisture will fill the pores and through the sweat follicles find a more ready entrance into the tissues beneath.

It is a fact that when the electricity traverses through a portion of the body, that portion which is situated under the electrode becomes reddened, and the capillaries are dilated as there is an increased flow of blood to the part; in consequence of this the current becomes slightly stronger as the application is continued, because of the increased vascularity, thus augmenting the conducting qualities of the tissues.

The thickness of the epidermis differs in different people, as well as does its moisture In those cases in which the skin is most moist the local and superficial action around the needle in electrolysis is most marked. In

one case, on account of the dryness of the skin, a current is required of from two or three times as many cells to accomplish the desired result as is required in a case where the horny layer is thin, or full of moisture, or both. Again, when the patient is perspiring freely, so that the skin is moistened by the perspiration, the same holds true.

The hydroscopic condition of the atmosphere has a slight yet perceptible effect on the conductivity of the skin. The less moisture the air contains the dryer will be the skin, all else being equal, and the greater will be the voltage required to overcome this resistance.

In those cases in which the sebaceous glands are active and the skin is kept well protected with the fatty secretion emanating from them, we find that there is much less tendency to destruction of the superficial layers of the tissues, because this oily substance aids still farther in reducing the conductivity of the outer layers of the skin.

As the sweat glands and ducts are not

situated near the hair follicles unless by accident, and physiologically have nothing to do with the hair growth, their consideration here is not necessary.

SEBACEOUS GLANDS.

The case is different with the sebaceous glands. These glands are almost if not invariably associated with hairs. In one case the hair uses the duct of the gland as its point of exit and is secondary to the gland. In another instance the gland opens into the hair follicle near its neck and the gland becomes secondary to the hair. In each case the hair serves as a distributing medium for the secretions of the sebaceous glands. This is accomplisled in part by means of capillarity and in part by the arrector pili muscle, which by its contraction and relaxation causes the hair to move, and also compresses the gland and causes its secretion to be distributed upon the surface of the skin.

In consequence of this intimate relationship existing between the hair and sebaceous

follicles we are not surprised that they are histologically closely related.

The sebaceous gland is imbedded in a dense connective tissue containing blood-vessels, nerves and lymphatics. The gland proper consists of a basement membrane, or sac, which is continuous with a transparent membrane lying beneath the rete Malpighii and above the corium, and has a similar structure. This basement membrane is continuous with and forms the inner layer of the hair sac. In this basement membrane are the secreting cells, the secretions filling the sac. These glands are almost without exception acinous, the divisions of a single gland ranging from two to twenty in number.

The minute anatomy of the tissues which are in intimate relation with the hair, will be taken up in the following order: the hair follicle, the hair papilla, the root sheath, and the hair itself. All hairs conform to the general type to be described, but there are anomalies, the understanding of which is of

importance in this investigation and will be taken up later.

A terse statement of the anatomy of the hair and its surrounding tissues is as follows: The hair papilla may be considered as an hypertrophied papilla of the skin situated at the bottom of an invagination of the skin —the stronger the hair the deeper is this depression. From this papilla originate a multitude of cells which are super-imposed the one upon the other, gradually losing their cell characteristics and becoming agglutinated together, thus forming the hair shaft.

THE HAIR FOLLICLE.

This is composed of three layers or sheaths: the external, or fibrous layer, whose fibers run parallel to the hair shaft, is continuous with the corium, and of like structure to it, and merge into the sub-cutaneous fibrous tissue whenever the root is beneath the under surface of the corium. In consequence of this there is no sharp dividing line between the loose connective tissue and the external sheath. Some fibers from this layer enter

The hair papilla, and within this sheath are found the blood-vessels and nerves of the hair follicle.

The middle sheath consists of a few connective tissue fibers between which lie oval nuclei imbedded in a granular substance. This sheath begins at the neck of the follicle and follows it to the bottom where it passes within the papilla. In this sheath the capillaries of the hair follicle are found.

The internal sheath is composed of a homogenous structure which is not altered by the action of the acids or alkalies, and which is similar to the transparent membrane found between the rete Malpighii and the corium.

The hair papilla is formed from the stroma of the hair follicle sheaths, especially from that of the middle sheath. It consists of connective tissue between the fibers of which are found numerous round cells, and in this connective tissue is found the nutrient artery with its accompanying vein, as well as non-medulated nerve fibers. It is separated from the hair root by a sheath. From this papilla

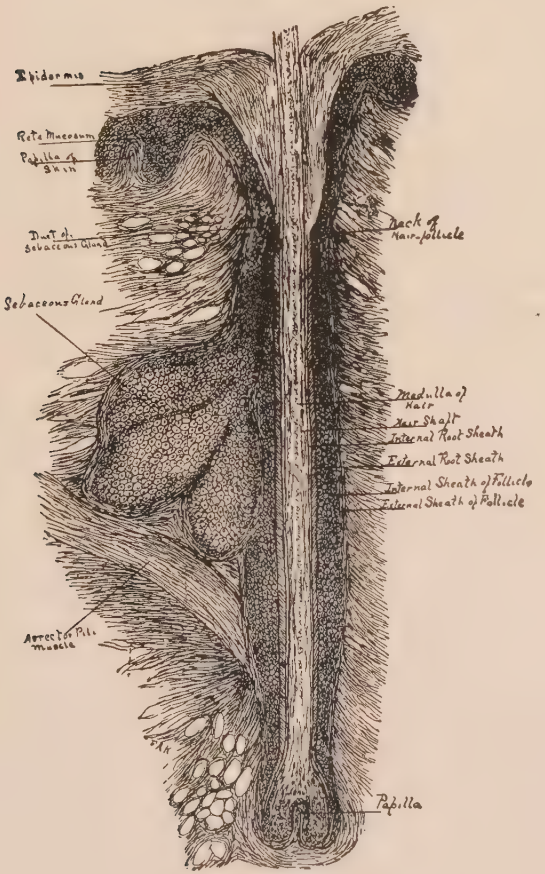
Epidermis
Rete Mucosum
Papilla of Skin
Duct of Sebaceous Gland
Sebaceous Gland
Arrector Pili muscle
Sack of Hair-follicle
Medulla of Hair
Hair Shaft
Internal Root Sheath
External Root Sheath
Internal Sheath of Follicle
External Sheath of Follicle
Papilla

FIGURE 1.

are produced the cells which form the substance of the hair and the pigmented particles which give its color.

At this point I desire to call especial attention to the structure of the follicle taken as a whole. Ordinarily its orifice is somewhat funnel-shaped (Fig. 1), although occasionally the skin surrounds the hair so closely that this funnel-shaped aperture is almost if not wholly obliterated (Fig. 2).

Just external to the contraction known as the neck of the root-sheath, we usually find one or more sebaceous ducts from sebaceous glands opening at an acute angle. and so situated, many times, that a fine needle such as is used in electrolysis would find its way into the sebaceous gland rather than follow the course of the hair follicle (Fig. 1). Below this neck the follicle gradually increases in width until it reaches the bottom, where ordinarily the greatest width occurs. The fibrous tissue and the transparent membrane which compose the sheaths of the follicle form a dense fibrous sheath through

which the blunted electrolytic needle will not readily pass unless a current of some strength causes the tissue to undergo such disinte-

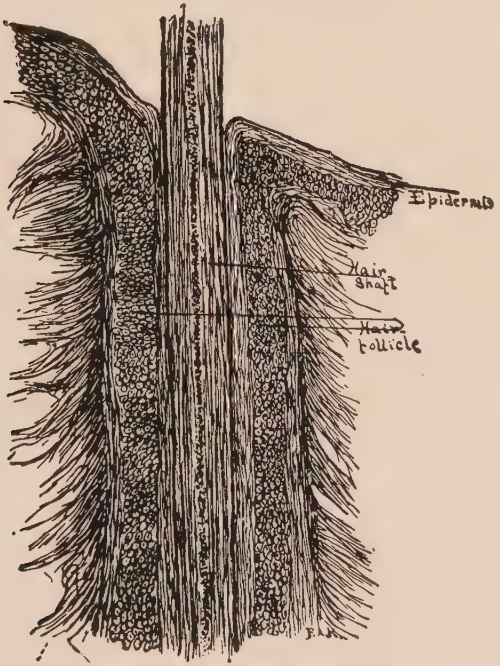

FIGURE 2.

gration and softening as to allow it to readily pass. This sheath serves as a decided adjuvant in our attempts at guiding the needle

to the papilla, and on the destruction of which rests the success of the operation.

Extending from the surface of the skin to the neck of the follicle is the same structure and cells as are found upon the surface of the skin. Beneath the neck we do not find any of the cells characteristic of the epidermis.

Within the sheaths of the follicle is situated the hair root with its two sheaths.

The external root sheath consists of cells similar of structure to those of the rete Malpighii. The thickness of this sheath is greatest in the middle portion between the neck of the follicle and the papilla, at which latter point this layer may be almost if not entirely wanting. At the neck, in consequence of the pressure, the layer of the cells is very much less than at a point farther down.

The internal root sheath consists in its upper part of a transparent and almost homogeneous substance which is not stained except at a point near the hair papilla where

the cells have not undergone that change in structure which renders them transparent.

The connection between the internal root sheath and the hair shaft is in many instances less firm than between the internal and external sheaths. In making microscopical preparations both longitudinal and transverse to the hair I have repeatedly found the section of the hair shaft has dropped out of the preparation, thus spoiling what would otherwise be a good section. The forcible removal of the hair by traction will frequently remove the hair shaft only, leaving the root sheaths in situ in the follicle.

Within the inner sheet is found the hair itself, which is made up of cells which have become changed in such a manner as not to be readily stained, and which form the hair proper. The extremity of the hair in which the papilla is received is knobbed.

As the more minute description of the cells composing the hair proper will be of no aid to us, we need not continue the subject of its structure farther.

VARIETIES OF HAIR.

There are at least two distinct varieties of hair. The first is the lanugo, or wool-like hair found upon the surface of the skin, and seen in its perfection upon the faces of women especially. This hair is the first formed in fœtal life. Its function seems to consist to considerable extent in the distribution of the oily secretion of the sebaceous glands. The majority of these hairs take their origin from a crypt in the side of the sebaceous gland, or from one of its acini; in this latter case the hair papilla is continued a short distance beneath the lower surface of the gland. As these hairs are small and they use the orifice of the gland as their point of exit. and as the gland tissue predominates and the duct of the gland is many times more than sufficient for the passage of the hair, the hair is considered secondary to the gland proper.

Occasionally these hairs, for some unknown cause, become hypertrophied and then give rise to the monstrosities that are so eagerly

sought for by our dime museums. Jo-Jo, the Russian dog-faced man, is an example of this hypertrophy of the lanugo hairs. When this occurs upon the face of women it becomes a deformity, and they at once remove the hair by some of the means so ordinarily used.

The second variety is the strong hairs which develop at different periods of life on different portions of the body. They undoubtedly were originally lanugo hairs but the follicle became more pronounced and the papilla more deeply located in the tissues as the hair growth became stronger. In place of the hairs being secondary to the sebaceous glands these glands are now secondary to the hair, and the gland duct opens into the hair follicle at an acute angle just external to its neck. These hairs appear, according to the portion of the body on which they are located, at various periods from birth or the latter portion of intrauterine life to thirty years of age. The structure of the skin at the seat of the hairy growth and the irritation the hair

may have been subjected to in the attempts at removal modify the growth relative to the depth of the papillæ beneath the surface of the skin, the firmness of the attachment of the hair growth and the attachment, structure and size of the root sheaths.

There is no strong line of demarkation between the two extremes of the thin (lanugo) and the strong hairs—the one verges into the other almost imperceptibly.

There is a variety of hairs which I have not seen described in any of our text books; and while I have found it on the face of the living, I have yet failed to get a good example of it in any specimen that I could make microscopical sections of. From the microscopical examination I am confident that it takes its origin from the corium and never attains any great length. In one case which I had, this growth, to the touch, reminded one of the beard of the man the day following the one on which he was shaved. These hairs are usually without color, and rarely

attain a length greater than one-eighth of an inch. Very slight traction with the epilation forceps causes them to drop out, and when examined with a magnifying glass they are seen to have a little knob-like end, with comparatively little or no root sheath. In the case above alluded to, the patient was certain that these hairs were returns and that my work had not been properly done. It required but little argument with the demonstration of the length of the hair root, to convince her of her error.

When hairs are forcibly pulled out we find that ordinarily one of four things occurs: First, the hair may be removed, leaving behind it both root sheaths in situ in the follicle; in another instance both sheaths may be removed with the hair; in stilll another instance the inner sheath may be removed, the outer sheath remaining; and finally, the hair may carry with it both root sheaths, and on account of their firm attachment at the neck of the follicle, the sheaths turn upon themselves like the finger of a glove stripped

over the hand, and are left hanging from the follicle but turned wrong side out.

Some time since I saved a number of hairs on which electrolysis had been employed before their removal, and in which the root sheaths were so dense and firm as to deflect the needle in an attempt to carry it to the bottom of the follicle; the current, however, was used sufficiently long to effectually loosen the outer root sheath from the follicle, and traction was then made and the hair removed, carrying with it both sheaths. These hairs I have since made sections of, both longitudinal, transverse and stained, and have examined under the microscope. I found that wherever the current had been used so that the root sheath was brought in contact with the liberated alkalies (the negative pool having been used) that the cells were so altered in structure as not to take the staining of hematoxylon so as to bring out the cell walls and nuclei, in this respect causing the tissue to resemble in its structure that of the inner sheath. At some little distance

from the point of electrolysis the cells would be found to gradually become outlined by the staining fluid. Another phenomenon was present which speaks strongly of the mechanical action of the hydrogen liberated at the negative pole. Everywhere through this sheath were found holes, some round and others oblong, which looked as though they had been punched out with some instrument which cut a clean, smooth hole without burring (Figs. 3 and 4).

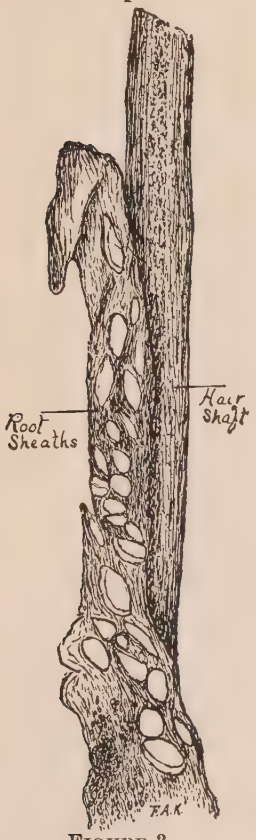

FIGURE 3.

In figure 4 the holes produced by electrolysis are well shown in the external root sheath but the cells are shown as

though they had not been acted on by the products of electrolysis. In the section from which this drawing was made the cells contiguous to the holes are hardly discernible on account of their not having taken the stain

FIGURE 4

well. The half of the sheath in which the holes are located looks almost as though it were without structure while the other half is well stained and the cell walls and nuclei are well brought out.

The depth of the papilla beneath the skin varies from that of the finer lanugo hairs, whose papilla are found on the corium, to

those of the large, stiff hairs found on the neck which pass through the true skin and

FIGURE 5.

are surrounded by the sub-cutaneous fibrous tissue with its meshwork containing fat cells, the hair follicles thus varying from one-

thirty-second of an inch to a quarter of an inch in depth.

While the above given type of the minute anatomy of the hair answers for the description in nearly all cases, yet there are exceptions in their structure which make it difficult to follow the hair to its papilla. In some instances, as in Figure 5, the shaft of the hair turns at an obtuse angle just above the papilla so that the papilla is situated at one side of the point where the tip of the needle would reach, and if the current were continued the follicle would be pierced and the needle would not have destroyed the papilla. In other cases the structures within the follicle are so dense and fill it so completely as to prevent the carrying of the needle along the shaft of the hair to the depth of the follicle. In the case of lanugo hairs starting from crypts in the side or from the bottom of the sebaceous gland (Fig. 6), there is great difficulty in reaching with any degree of certainty the papilla.

The direction of the hair as it leaves the

skin is not always a true index of the direction the hair takes beneath the surface of the

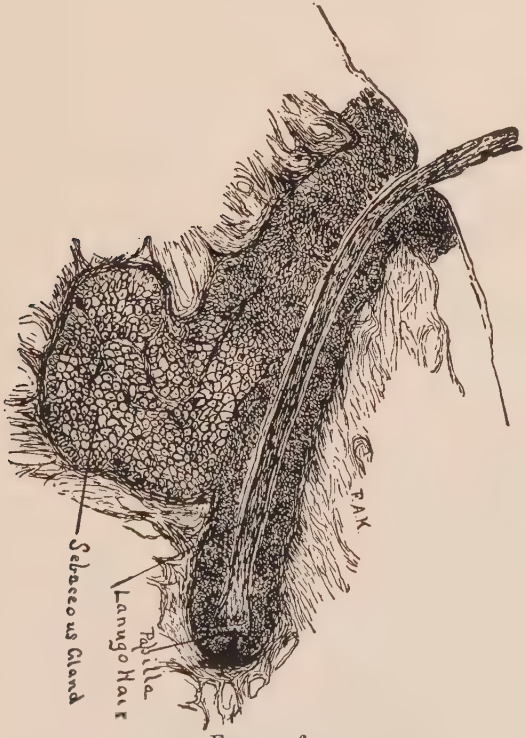

FIGURE 6.

skin, especially in the case of the lanugo hairs. Fig 6 illustrates this point very

well. The funnel-shaped orifice of the follicle may have no existence as in Fig. 2, or it may be clogged with dead epithelium so as to form a decided obstruction to the introduction of the needle.

CAUSES OF HAIRY GROWTHS

What causes the growth of superfluous hair upon the face is a point on which the authorities are not agreed. There are two or three factors which have been recognized as possible causes in some of these cases. Of these hereditary and consequently racial characteristics hold the most prominent place.

The Mongolian, the American Indian and the Malay have but a slight growth on their faces and for them the amount of hair that is ordinarily found on the faces of Europeans would amount to a deformity. While each race has its own characteristic hairy growth, yet we find that individuals of the same race differ as widely from each other in regard to hairy growths as do the races.

In many of my cases I have been able to find that either the mother had a hairy growth upon her face, or that the patient resembled the father very strongly, the father having a decidedly heavy and strong beard. In one instance a patient of mine had such heavy eyebrows that they became a deformity. She remarked that it was hereditary, and that her grandfather's eyebrows were so heavy that he was known as the man of the eyebrows. I have had repeatedly under my care at the same time a mother and daughter for the removal of this growth.

Often this growth is met with in young women in whom the menstrual function has very recently been established, and the growth seems to resemble in part the appearance of the beard upon the face of the young man and is possibly due to some reflex incident upon the establishment of menstruation.

The majority of my cases have usually been in women of thirty years of age or over, who have never married, many of them being school teachers. In these cases I have been

inclined to attribute the fact of hairy growth to the inactivity of the uterus; this class being unmarried and consequently without family. To this class may also be added women who are sterile.

Another class is found in those women who are nearing or passing the menopause, and whose faces have been free up to this time, but now take on a hairy growth.

In all of these cases except that of heredity, these hairy growths seem to depend, to some extent at least, upon uterine reflexes.

The most marked case of hairy growth from uterine reflex that I have seen mentioned is that reported by Wm. S. Gottheil, M. D., of New York. This case, a Jewess, became the possessor of a strong beard, and during the time of its growth and continuance was affected with amenorrhœa. Dr. G. removed more than ten thousand hairs from her face. Some time after this her menses reappeared, and coincidently "she noticed that the few remaining hairs upon her face fell off, and that there was a slight defluvium

capillorum of the other normally hairy portions of her body.''

To the causes already enumerated may be added the irritation produced on the skin by the attempted removal by various means of a slight hairy growth. The ordinary methods employed by the patients stimulate the skin, and thereby increase the strength and depth of the growth.

At this point it may be of interest to mention some of the means used by patients for the removal of the hair. Most frequent of all is the use of epilation forceps, then the use of a fine variety of pumice-stone, and also the various depilatories in the market—caustics which destroy that portion of the hair external to and slightly below the surface of the skin, in this respect making a closer shave than is possible with a razor; then follows the wholesale epilation by means of adhesive plaster; then is the razor used, and occasionally the patient singes the hair from her face by means of a burning candle, or some similar source of heat. It is

not necessary to state that these means are inefficient, as well as harmful; for by their irritation they increase the hairy growth, and cause the hairs that ordinarily would not have grown to increase in size and depth of root.

CHAPTER III.

NECESSARY APPARATUS.

GALVANIC BATTERY.

The first requisite is a galvanic battery. Any form of galvanic battery which is used in electro-therapeutics is suitable for electrolytic epilation. The author has used an ordinary zinc carbon cell with bichromate of potassium and sulphuric acid as the exciting fluid, the chloride of silver, the specific gravity (Callaud), and the Leclanche batteries. He has used three different sizes of chloride of silver batteries in this work—large, medium, and small, the small size having plates whose surface was not more than one-third of that of the larger size. He was not able to see any difference in the results, whether a large or a small size was used.

The number of cells used has varied from two to twenty, the last mentioned number

being rarely used on account of the pain experienced by the patient. Most authors recommend that from ten to sixteen zinc carbon cells be used, or a current of from two to six milliamperes. The consideration of this point, however, will be taken up in Chapter IV (Mode of Operating).

Whatever battery is used, the essential point is that it be in good working order and constant in action. The size of the cells and surface of the plates need not be considered, as long as a good current can be obtained. The resistance of the body to the passage of a current is so great that with the number of volts of electro-motive force used in epilation by electrolysis there is but little or no difference to be observed in the rapidity of the action or extent of the destruction of the tissue around the needle, whether the large cell with large surface of the exposed plate, as is found in the cautery battery, or the smallest instrument for electro-therapeutics, is used. I have used the current from a freshly-charged cautery

battery, and have been unable to see that any more was accomplished than would have been had I used a like number of small cells of a similar battery. It is only when a large number of cells have been joined together for tension and we have a voltage of fifteen or twenty times that of single cell, that increased electrolysis would be noticed around the poles should the large size be used.

In this operation we desire to destroy the hair papilla with the least amount of destruction of the other tissues, and consequently desire only such strength of the current as is necessary to have the rapidity of electrolysis completely under our control.

CONDUCTING CORDS.

These should be flexible, of light material, and with sufficient conducting surface so as to interpose little resistance.

Their points of attachment to the battery and electrodes should be so thoroughly made that the current will not be broken with ordinary usage.

Cords which have been long in use will many times become useless because the conductor within has become oxidized or broken. A slight break in the metallic circuit is apt to cause great pain to the patient; connection, therefore, should be thorough and the cord intact.

The length of the cord should be sufficient so that the needle holder and electrode can be used without the inconvenience caused by the cords being a little short.

THE ELECTRODES.

I have invariably used the positive electrode placed in a moistened sponge and applied to the body either near to or at some distance from the point of electrolysis.

The negative pole is the one to be connected with the needle, although in some cases the reverse has been employed.

My preference for the positive electrode is a large flat one the size of the palm of the hand, covered on one of its surfaces with a sponge and on the other with a piece of

rubber (Fig. 7). These electrodes are best made of thin sheet brass or copper, as the zinc electrodes soon become brittle and the binding post is readily broken off. This electrode is usually moistened with water, but when the resistance of the body is great, the current is weak or the patient does not press the electrode firmly enough, it will be of

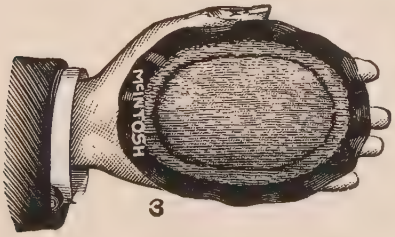

FIGURE 7.

advantage to wet the electrode in a saturated solution of common salt. As common salt usually contains traces of calcium and magnesium chlorides, that are exceedingly hydroscopic, the sponge will remain moist much longer than as though it were wet with plain water.

When water alone is used the electrode

may be made to serve as a rheostat. When the electrode is touched but lightly by a small surface of the hand the amount of electricity transmitted is very slight. The current may be increased by bringing a greater surface of the hand in contact with the electrode and also pressing the electrode firmly. Many patients soon acquire this knowledge and often materially aid the efforts of the operator. Occasionally a patient is found who so flinches from the pain of the operation that the operation can be accomplished only by increasing the number of cells used, by wetting the electrode in a solution of salt water or by applying the positive electrode to the face or body in close prox imity to the needle.

At times, however, in certain cases which have an idiosyncrasy relative to the action of the galvanic current upon them, it has become necessary to apply the positive pole in close proximity to the needle. In these cases I have used an electrode with a short, light rubber handle, terminating in a

metallic or carbon disk (Fig. 8.), this being covered with a bit of moistened sponge or wash leather.

THE NEEDLE HOLDER.

The negative electrode is the needle and is connected to the negative cord by means of

FIGURE 8.

a needle holder, which is made in various forms. That which I use is of slightly larger diameter than a lead pencil, made of hard rubber and about four inches long (Fig. 9.). The needle is grasped with a pair of jaws which are opened and closed by a screw situated at the end where the connection is made with the holder. The jaws are so arranged that

when the needle is in position it projects one-fourth inch beyond the jaws, as it is found very much more easy to determine the depth of the needle point beneath the surface of the skin when only this length of needle is beyond the jaws rather than as though it were twice or three times that distance. Some of the other advantages of having the needle point but one-fourth of an inch be-

FIGURE 9.

yond the jaws of the holder are that the needle being thin and of poor conducting material offers less resistance to the current, and that the needle is much more firm and more readily guided when held as above described.

There is a form of needle holder in which the current is made or broken by pressure upon a spring. While in some cases this may serve a good purpose there are objections which limit its usefulness. One of

these is the uncertainty of a good connection by contact only. Another is the decided shock to the patient when the current is made or broken in the metallic circuit, and which is in many instances decidedly unpleasant, painful, and unnecessary. If it is deemed necessary not to complete the circuit until the needle is in position there are other and better means of accomplishing this than by the above described needle holder.

It is well enough to have an assortment of needle holders varying from two to four and one half or five inches in length. If but one needle holder were to be purchased I should advise the shorter holder as being the one of greatest utility.

THE NEEDLE.

The success of the operation depends as much upon the material, shape, size, and construction of the needle as upon all the other apparatus.

Silver, platinum, irido-platinum, steel,

tempered and untempered, have all been effectively used.

If the needle be connected with the positive pole, the platinum, or preferably, the irido-platinum recommended by Dr. Hardaway should be used on account of its resisting the corrosive action of the oxygen, chlorine, and the acids. With this exception or in case a large needle is required the steel needle has my preference.

The all-important point about the needle is its shape. I early learned that a sharp-pointed needle was a detriment rather than a benefit. In my first attempts at epilation I bought the finest cambric needle I could get, broke off its point and slightly rounded it on a stone. The object to be attained is to carry the needle by the side of the hair deep into the follicle until it runs against the bottom of the follicle and near to the papilla. The sharp needle would in many cases penetrate the walls of the follicle and wander into the tissue far from the desired point,

and failure rather than success would be recorded.

The needle best adapted to all cases is the one made from the finest jeweler's broach (a four-sided steel instrument, tapering to a point, and used by jewelers for reaming out holes in the jewels of watches.) Dr. George Henry Fox was one of the first to advocate the use of the broach. The square corners of the broach are ground off on a fine emery wheel, and so ground that it is bulb-pointed, the neck behind the bulb point being considerably thinner than the point itself. Figure 10 is a magnified drawing of this broach. This point should never be sharp, but always blunt and rounded. After it is ground into shape a fine Arkansas stone will remove the coarser cuttings of emery, and polish the needle. I have found that needles

FIGURE 10.

ground in the way described differ in the ease with which they are used, and on examining them under a low power of the microscope, that the needle which is best is the one whose tip most nearly resembles a hemisphere.

As the broach is made of hard-tempered steel the needle is apt to break unless the temper is drawn, which can readily be done by heating it in the flame of an alcohol lamp until it becomes red, after which it may be removed and cooled slowly. This I did at the suggestion of my friend, Dr. J. E. Colburn, of Chicago. Great care must be used in drawing the temper of the finest needles lest they take fire and burn should they be introduced into the naked flame of the lamp. In drawing the temper of the fine needles it would be best to place them on a piece of sheet-iron or platinum and heat them rather than allow them to come in contact with the flame. The ease with which the needle takes fire and burns affords as good an illustration of its thinness as does a

statement of its diameter in fractions of an inch. I find that the needle thus prepared retains sufficient rigidity for our purpose and at the same time it may be bent at a right angle and straightened again without breaking.

There are two makes of broaches that may be obtained at the wholesale jewelers, the one of Swiss manufacture, and the other made of Stubbs' steel. The latter variety is by far the best.

Those who have used the needle as above described find that they can do the work so much more satisfactorily and readily that they will not use no other needles.

The irido-platinum needle when made as thin as the above described needle, becomes so pliable that it is almost useless. It is only when a comparatively large-sized needle is used that the irido-platinum needle is of avail.

It is always well to have an assortment of needles on hand, varying in size from the

thinnest up to the size of the very smallest cambric needle. While the thin needles are applicable in nearly every case, the large ones are occasionally useful in the removing of hair from those faces in which the follicles are comparatively large, and the hair grows from a shallow crypt from the side of the follicle.

EPILATION FORCEPS.

Figure 11 shows a cut of epilation forceps.

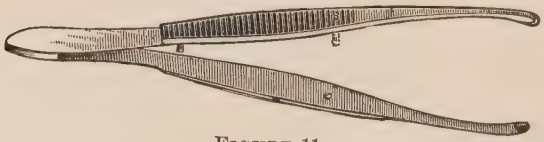

FIGURE 11.

The requisite in these instruments is that the point shall be about one-eighth of an inch broad and so ground that by whatever part of the jaws the hair may be caught, the hold will be firm.

MAGNIFYING GLASS.

For years I used nothing but the naked eye in my work. I had tried various forms

of magnifying glasses and abandoned them, for I found that when I used both eyes the stereoscopic effect was superior to the advantage gained by a magnifying glass which permitted the use of but one eye. For while the distances are slight it is essential to use your power of judging of distance as though it was much greater.

Some two or three years ago I procured a lens of from two to three inch focus, mounted in hard rubber with a light handle attached. This glass may be held by an arm with a universal joint so arranged as to be readily adjusted over the point of operation. By holding this lens within an inch and a half or two inches of the face, I found that I could use both eyes, and while retaining the stereoscopic effect I had added to it a slight magnifying power. This glass has been of such advantage that I almost invariably use it. Any glass of such magnifying power and dimensions as to preclude the use of both eyes, will soon be abandoned by the operator attempting its use.

RECAPITULATION.

The absolutely essential apparatus consists of a battery of from three to fifteen cells, a pair of conducting cords, an electrode for applying to the surface of the skin, the needle, needle-holder, and epilation forceps; to this may be added as a useful adjunct, a magnifying glass.

CHAPTER IV.

MODE OF OPERATING.

From the chapter on histology it is readily seen that cases differ very decidedly in the character of the hair growth, and in the relations of the follicle and root sheath and sebaceous glands to the hair.

ILLUSTRATIVE CASES.

CASE 1.—Let us take for our illustrative case one of those in which the needle readily passing by the side of the hair reaches the bottom of the follicle contiguous to the papilla.

In case you should have one of this character for your first patient, the ease with which you accomplish the result will, in all probability, make you over-confident, and should your next case be of the difficult kind, your disgust at seeing a large percentage of the hairs return, and the discouragement of

your patient thereat, will make you wish that you had been a little more guarded when you took the second case.

Having a case of the first mentioned type the patient is placed in the operating chair, or on a lounge, in a good strong light, and the operator places himself in such a position that he can get a good view of the hair as it emerges from the skin. The positive electrode having been laid upon a rubber cloth in the patient's lap is in readiness to be pressed upon by the hand of the patient whenever the operator may so direct. The negative electrode is the needle, and is held in the hand of the operator together with the epilation forceps, this last being held by the second, third and fourth fingers and the palm of the hand, while the needle-holder is held by the thumb and forefinger of the same hand. The battery is already in connection with the cords, and two or three cells are thrown into the circuit. The needle is then introduced by the side of the hair, and gently follows the direction of the hair as it emerges

from the skin until it meets a slight obstruction. The patient is then directed to place her hand upon the sponge. Should the current be strong enough there will, in the course of five or ten seconds, appear a little froth about the needle as it enters the follicle. If this should not occur, the current is too weak to overcome the resistance interposed by the patient, and more cells should be gradually added until the desired result is obtained. A slight pressure should be made upon the needle, and after fifteen or twenty seconds it should be removed and gentle traction be made upon the hair with the epilation forceps.

For safety to the needle, immediately upon its removal the author takes the needle-holder in his lips while using the epilation forceps.

If the hair is not removed when slight traction is used the needle should again be introduced by the side of the hair, and the current continued a little longer, after which the use of the epilation forceps is repeated.

It may be well enough, should the hair now remain firmly fixed, to use force enough to remove it, after which the needle can be again inserted into the follicle when it will ordinarily follow in the course of the removed hair and reach the papilla which may not have been destroyed.

If, before this has been accomplished, the amount of gas disengaged around the needle be great and the appearance of the tissues indicate that there has been such a destruction of tissues as may result in a noticeable scar, or something approximating thereto, it will be wise on your part to desist from operating on this hair. I find, however, that should the hair be allowed to remain, it is quite liable to cause irritation to the sore which results. I therefore remove the hair, knowing that it will return again, and that at my second attempt my success may be demonstrated by the ease with which the hair is removed.

Should the patient be very sensitive to the electrical current, I have found that less pain

is produced when the needle is introduced before the current is completed. The patient is then directed to press or grasp the electrode with the hand, and before the needle is removed is requested to remove the hand from the electrode. By this means the slight shock on making and breaking the current is much less than when the needle is introduced or removed without the current having been broken as above described. If this precaution is not taken, you will find that some of the superficial muscles, some fibers of the platysma, for instance, may be thrown into contraction sufficiently great to interfere with your carrying the needle into the hair follicle. If the connection is made or broken in its metallic circuit, as for instance in the handle of some of the needle-holders, a decided shock is produced which becomes exceedingly unpleasant in some of the cases.

The point to be remembered, and to be insisted upon, is not to allow the current to be continued long enough to produce a visible

scar. It is better by far that three or four attempts be made before the hair is permanently removed than that the face should be marred by an unsightly scar.

CASE 2.—We have a case in which the root sheath is of such dimensions and firmness that it most effectually blocks the way at the neck of the follicle.

The question is how to overcome this obstruction and not pierce the hair follicle, particularly that layer given off from the corium, which is firm and fibrous in structure, and on which we principally depend to guide the needle to the bottom of the follicle. Surrounding the hair is this root sheath made up of cells, but so firm in its nature as to prevent the forcing forward of the needle, no matter how thin it is. Should the attempt be made to carry the needle to the papilla there is great danger of piercing the above-mentioned fibrous layer near the neck of the follicle, and so far from the papilla that its destruction becomes a question of great doubt. After piercing the follicle the needle

reaches the more open mesh-work of the lower layer of the skin, where little or no resistance is offered to the passage of the needle.

To answer this question, I allow the current to pass as soon as the needle is arrested at the neck of the follicle. In place of using pressure, and endeavoring to carry the needle forward through the resisting medium, I endeavor to make the needle pass around the hair and to produce cauterization upon the row of cells at the constriction, and carry this to such an extent that when traction sufficient to remove the hair is made upon it, the hair with its root sheaths will come away intact. The needle can now readily be introduced in the track of the hair, and will reach with a considerable degree of certainty the papilla so as to destroy it. If the electrolytic action at the neck of the hair follicle has not been continued sufficiently long to loosen the cells at this point from its walls, the hair may be withdrawn, leaving its sheath behind it, or the sheath may turn

upon itself as do the fingers of a glove when stripped from the wrist over the hand. In this instance you may as well desist from your operation upon this particular hair, for it will be impossible to reach the papilla with any degree of certainty, as the root sheath most effectually blocks up the passage.

CASE 3.—Now we have a case in which a lanugo hair springs from the side of a sebaceous gland or one of its crypts. The direction of the hair after it leaves the skin is different from its direction beneath the surface of the skin. (Fig. 6.)

If in this instance a fine needle be used, the probability is that the hair papilla will not be reached. Should a coarse needle be used, the sebaceous gland will be put more upon the stretch, and the possibility of reaching the papilla will be increased. If, however, the hair should not be destroyed, the current should be continued as long as is safe to do so without scarring. Of course a portion of the sebaceous follicle will by this

means be destroyed, and after the lesion is healed the hair may be again operated upon with increased prospect of its eventual removal; but in the operation, that particular sebaceous follicle may have been almost if not quite destroyed before the desired result is attained.

Case 4.—In this case the hair is of the variety something between that of the lanugo hair and the ordinary superfluous hair already described. The papilla is situated at the depth of a sulcus between two papillæ, and which, while it does not reach as far below the corium as do the ordinary hairs, it is deep enough to be more firmly fixed than the lanugo hair.

If in this case the needle is carried down by the side of the hair and sufficient pressure is used with the electrolytic action to cause it to pierce the follicle, the papilla may not be destroyed. In many instances the amount of fluids in the tissues surrounding this variety of hair is limited on account of its being superficial, and if the needle pierces into the

deeper layer where the tissues contain more moisture, electrolysis will take place here more markedly than in the drier tissues surrounding the papilla.

In many cases the operator can readily differentiate between the varieties of hair in the above given cases; but occassionally the most skillful expert would be deceived as to the depth of the hair papilla beneath the surface of the skin.

THE SHEATHS OF THE FOLLICLE A GUIDE FOR THE NEEDLE.

In all cases the fibrous layer of the corium which forms a portion of the root sheath serves as an obstruction to the passage of the blunted needle. The disintegration of the tissue which takes place around the needle, gradually allows it to be pressed forward with but little force until this layer at the bottom or side of the follicle may have been pierced. The skilled operator will at once recognize in the little jump which the needle takes as it passes through the obstruction, and the ease with which it passes

through the mesh-work of the sub-cutaneous tissue, that it is outside of the follicle.

The four hypothetical cases above given include nearly if not all of the variations which we find in the different cases of hairy growths. Sometimes in a single case we find examples of all of the above described conditions. Usually the hair found upon the upper lip conforms to the first hypothetical case, while that upon the chin, especially if the skin is of close texture and the hairs have been repeatedly removed, is of the type of the second case; while the third case is usually found in those people whose skin is coarse, the pores large, and the hairs are hypertrophied lanugo hairs. Occasionally the author has met with still another class, which, however do not ordinarily require to be removed by means of electrolysis, because the hair itself falls out, or is removed by the traction to which it is subjected in the ordinary washing and wiping of the face. As this variety has been described in Chapter II it needs no additional mention.

In the illustrative cases the negative pole has been the one attached to the needle and is the one that should invariably be used. It is true that when the needle is attached to the positive pole the pain experienced is of a different character and less severe than as though the negative pole were used. With the positive pole the lesion is not as extensive as with the negative. The time required for the removal of the hair is longer with the positive and the appearance of the tissues surrounding the needle is not as good an index of the work done as when the negative is used. The greatest objection to the positive pole, however, is the danger of leaving a permanent indelible stain, due to the formation of insoluble salts or oxides with the metal of the needle.

It seems almost superfluous to state that the galvanic current should be the only one used in epilation or any other electrolytic work, yet it is necessary to do so and to emphasize the fact. I have had patients apply to me for treatment in which the

faradic current had been used for this purpose and the pain occasioned thereby had been almost unbearable and there had been absolutely no benefit whatever.

HOW TO GAIN EXPERIENCE.

In no operation where human life is not involved does experience count for more than it does in this comparatively simple and easily executed procedure.

It is told of a famous oculist who, when a patient complimented him highly on the success with which he had performed the operation for cataract, replied that it was nothing to do such an operation now, but that he had spoiled a bushel of eyes in learning how. History does not record whether or not the patient was grateful that his eye was not one of that bushel.

It is not always that the one who first attempts epilation by electrolysis finds a patient who is willing to submit her face to his inexperienced manipulations.

In the first place, whenever it is possible

to watch the operation as performed by an experienced physician it is advisable that this should be done. There are many little points in the technic of the operation that contribute materially to its success which can be better mastered by observing the operation than by reading any description of it.

It has been recommended that the beginner attempt the removal of hairs situated on portions of the body other than on the face and that no attempt be made on the face until he has become expert. While much can be accomplished by this method, yet the characteristics of the hairy growths on the back of the hands and arms and elsewhere on the body are different from those found upon the face and usually conform to but one of the cases before mentioned; so that at best but a partial experience can be gained in this manner.

THE LESION OF ELECTROLYSIS.

From what has already been said, it will be seen that for our purpose electrolysis is

only a method of using a caustic acid, or alkali, and limiting its action to a definite point or tract.

When the negative electrode is used for electrolysis, as in the cases previously stated, we have the action of potassium and sodium hydrates, which destroy the tissues without coagulating the albumen. The activity of the caustic alkalies not being interfered with by an insoluble barrier of coagulated albumen causes the tissues to be destroyed to a much greater distance from the needle than as though the positive pole had been used. In addition to the liberation of the caustic alkalies, we have also the appearance of hydrogen which on account of its high diffusibility, passes between the interstices of the cells and causes a mechanical disintegration of tissue. A certain portion of the hydrogen becoming mingled with the albuminous fluids of the tissues forms a froth which appears around the needle, and serves as an index to the strength of the current and the rapidity of the destruction of tissue.

Amory describes the shape of the lesion as being conical, with its base at the surface of the skin and its apex, somewhat rounded, in the tissues beyond the point of the needle. This is true provided the needle be conical and tapering to a point, for in this case the needle will be in close contact with the skin at the orifice of the follicle and, while the skin is not so good a conductor of electricity as it is in the deeper and more moist parts of the follicle, the surface of contact is greater. With the bulbous pointed needle used by the author the lesion is more cylindrical in shape, and the external surface of the skin is not destroyed for so great a distance from the needle as when the cone-shaped needle is used.

The amount of destruction of tissue depends primarily upon the strength of the current, and secondarily upon the length of time that it is allowed to continue. A current which may destroy the tissues surrounding the needle for sufficient distance to include the hair papilla within ten seconds,

may be strong enough to cause great pain to the patient and leave a scar unless the utmost care is taken. A weaker current under like circumstances will accomplish this same result of destroying the hair papilla, but the time consumed will be proportionately lengthened. The patient, however, will not begin to suffer the pain which was experienced when the stronger current was used.

In consequence of the action of the caustic alkalies and the hydrogen on the tissues surrounding the needle and the collection of the fluids at the negative pole by reason of electrical osmosis, we find the volume of the tissues increased so that they may be slightly raised above the surface. In immediate proximity to the needle they become whitened and appear almost as if they had been frozen; from this it gradually shades into an erythematous blush and from this verges into the normal color of the skin. This lesion in some instances, after the needle has been removed, looks very much like a mosquito bite, or the sting of some other

parasite. If left to itself the center of the lesion where the destruction was most complete, dries down and forms a brownish eschar. The redness soon disappears, and but for the small eschar, there is hardly anything noticeable after three days. In some cases, however, the inflammatory action is more marked, and a week or ten days intervenes before the effects of the electrolysis have entirely disappeared. In the center of the lesion we will find that the tissue is completely destroyed; a little further out the vitality is so impaired as to make its destruction and removal a question of doubt. Still farther away from the center, the tissue will, in all probability, become normal, provided its vitality is not lessened by being contiguous to similarly affected tissues on the other side because of the application of electrolysis to a hair within an eighth or a sixteenth of an inch from the original hair removed. For this reason it is always advisable not to remove the hairs, too near together, at one sitting for fear that the

vitality of the little bridge of tissue intervening between the two lesions may be so lowered as to break down and form one comparatively large eschar, and consequent scar with possible pitting of the skin. This fact prevents our making use of the slight anæsthesia which is produced around the needle by the electricity. If the skin is moistened by perspiration or being recently washed, the action of the electricity upon the surface layer is apt to be much more marked than in cases where the skin is dry or oily. At times I am confident that the action of the electricity has been lessened on the external layers of the skin where it is not desirable to have the electrolysis take place, by means of the application of oleum lanæ, or some other oleaginous substance.

TREATMENT OF THE LESION.

Of the various methods I have employed I have found nothing that so thoroughly met the indications in each case as does the use of the oxide of zinc ointment. Parties who

have used other applications have without exception stated that the oxide of zinc ointment removes the effect of the lesion and causes the healing to take place very much more rapidly than by any other means.

I invariably caution my patients not to irritate the part by severe rubbing, or by trying to remove the little eschars that are produced, but allow them to remain as long as they will as a protection to the healing skin beneath them.

PAIN OF THE OPERATION.

In all probability there is no other method by which the sensitiveness to pain in different persons can be so readily demonstrated as by means of electrolysis. Each patient is a law unto herself. I have had patients who would become very sleepy and at times almost lose themselves under the operation, and others to whom this same current which I had used in the previous case with little or no pain would suffer so that the current had to be diminished or some of the methods for

local anæsthesia be tried. To but one or two out of the many whom I have treated has the operation been so painful that it has been abandoned by the patient on that account. Ordinarily, however, if the current is painful the number of cells may be diminished or the resistance of a rheostat be introduced until the point is reached where the current can be borne by the patient. In this case, however, the time consumed in the electrolysis will be materially lengthened.

In some cases the pain will be found to be greater on one side of the face than in identically the same position on the other side. As a general rule the pain is most severe on the upper lip near the edge of the nostril. Named in the order of their painfulness are the upper lip, the cheeks in front of and below the ear, the neck in the region of the larynx, and last of all the chin. It is a general rule that the current is more painful when applied in those regions where the bone is covered only by the skin. As all rules are said to have exceptions, so occa

sionally we find patients who complain most bitterly when electrolysis is performed on the chin, and can bear the same current on the lip with comparative ease.

The introduction of the needle to the depth of the follicle is not attended with any pain, provided that there is no connection with the battery, or the needle does not pierce the follicle. If now the circuit be completed the needle will seem very much as though it were being heated. This sensation apparently has remissions and increments like quick throbs or pulsations following each other with such rapidity as to almost give one a similar sensation as is produced by the low tones of an organ. In fact these pulsations do take place, for when the poles of a battery are connected together the electricity which has been collected at the poles is discharged, and for a minute fraction of a second there is a pause until by the chemical action of the battery there is accumulated sufficient electricity at the poles to overcome the resistance of the interposed body when another dis-

charge takes place. The sensation of heat above described has caused some to speak of the action of electrolysis as due to the heat produced. Heat, however, is not a factor in the case. If any heat is produced it is so small a fraction of a degree as to be almost if not quite incapable of demonstration. If one of the electrodes be placed on the cheek the patient will experience a metallic taste so marked that she may think she has a piece of brass in the mouth, yet we positively know that there has been no such metal near the patient's mouth.

Electrolysis is the conversion of galvanic electricity into chemical action, and the cauterization is brought about by the liberated acids or alkalies.

PREPARATION OF THE SKIN FOR THE OPERATION—LOCAL ANÆSTHETICS.

From what has already been stated, it is advisable that the skin should be as free from moisture as possible. In certain cases I am glad to say the number is small, the

pain of the operation is almost unbearable. For these cases I have used various preparations to produce local anæsthesia, and have finally come to use an ointment made according to the following formula:

R. Cocaine muriatis.....3j
Menthol.
Chloral.....āā 3ij
Olei lanæ.....ʒss.
M. et fiant ung.

In some instances the relief afforded has been so great that if I had neglected to use the preparation before commencing the operation, the patient would gently remind me that I had forgotten an important point. With others the pain seems to have been but little mitigated, and they are indifferent to the ointment,

I have used cocaine muriate on a moistened positive electrode, as recently advocated by some of our dermatologists, but have failed in every instance of obtaining the desired result. In the production of local anæs-

thesia in these cases ether or rhigoline sprays are all but useless, and the application of cocaine in aqueous solution is of no avail. one authority (Amory) recommends the pricking into the skin at the seat of operation a solution of cocaine. As to the utility of this method I am unable to speak, never having tried it.

If the skin is put upon the stretch or, in certain cases, if the sentient nerve distributed to that portion of the skin be pressed upon firmly, the pain will be found to be lessened.

IDIOSYNCRASY.

Occasionally patients are met with who are peculiarly sensitive to the galvanic current. Among my own cases this idiosyncrasy has been found in patients who are over the medium in weight and are ordinarily considered the picture of health. In these cases if the galvanic current were made to traverse any distance through the tissues so as to pass across or in the direction of the pneumogastric or other large nerve trunks,

a peculiar faintness and giddiness almost resembling intoxication and lasting from fifteen minutes to a half hour would supervene. In these cases the positive electrode was, after this idiosyncrasy was demonstrated, used upon the surface of the skin close to the point of electrolysis, and in each case when this method was employed it was successful in preventing these unpleasant symptoms.

THE OPERATION ANTISEPTIC.

Because of the caustics (alkaline, or acid) liberated at the poles, any germs which may have been upon the needle when it was introduced would in all probability be destroyed or their activity very decidedly lessened. I have, in a very few instances, tested the correctness of this statement by introducing the needle into the pus of an acne pustule and upon the same face have removed a hair by electrolysis without having cleansed the needle. In many instances no pustule would follow this inoculation.

Occasionally if the current used had not been of sufficient strength, or continued a sufficient length of time, a slight pustule has made its appearance. And very rarely a second pustule of a still milder type has appeared at the follicle where the needle was next introduced.

It is, however, advisable under all circumstances to see that the needle is perfectly clean (and consequently aseptic) and that if there is much of an acne eruption upon the face to avoid removing those hairs contiguous to such eruption. In cases of this kind it might be advisable to prescribe a lotion containing from one-two hundredth to one-five hundredth of a grain of corrosive sublimate combined with sufficient ammonium chloride to hold the mercury in solution. This should be used by the patient twice daily, and it would not be a bad plan to bathe the portion where the operation is to be performed with the same solution a short time previous to commencing the work. Sufficient time should elapse, however, to allow the

outer layer of the skin to become thoroughly dry.

After the operation is performed there is little danger from absorption from without, the eschar forming a comparatively good protection.

Although the means employed tend to make the operation aseptic, yet we would not be warranted in disregarding the proper care of our instruments or the rules of cleanliness which underlie modern antiseptics.

The platinum and irido-platinum needles may be held in the flame of an alcohol lamp until freed from any germs. The steel needles may be placed in boiling water or left a short time in a 95 per cent. solution of carbolic acid, or in strong alcohol.

LENGTH OF TIME REQUIRED TO REMOVE THE HAIR.

One of the first things that the patient asks is, how long will it take? To this I reply that I can average sixty hairs per hour, which I think is underrating rather than

overstating the truth. If a strong current be used possibly a hundred hairs may be removed within this time; but when this is done the probability of scarring the face is decidedly increased. In cases of great difficulty the number of hairs removed per hour may fall below the estimate of sixty.

Hairs situated on the lip and cheeks require, as a rule, less time than do those on the chin, and in those situated on the neck the element of time is greatest.

TIMES OF DISCOURAGEMENT.

As has already been hinted, there occur times of discouragement, and these times are sure to come if you have not forewarned your patient that some hairs will return. You must remember that your patients are morbid on the subject of what they consider a facial blemish; so much so that they are determined to have you remove all of the lanugo hairs that may be found upon the face. Again, they forget their appearance when they first came to you.

I have had patients come into my office and tell me that the work was a failure, that all the hairs removed had returned, and they, to say the least, were very much dissatisfied; almost without exception I have been able to convince them that their condition was much better than when they first came to me, and that it would require but comparatively little work to make the operation a complete success. These patients have subsequently become my warmest supporters.

Were it possible to prevail upon patients to have a photograph taken before the operation of the part of their face where the growth had been, the comparison would aid very materially in overcoming the discouragement. In every case we can absolutely promise that eventually every hair will be permanently removed.

PERCENTAGE OF RETURNS.

It has been shown that there are certain anatomical reasons why it is impossible at times to reach the hair papilla. In some

cases my success has been so great that two or three per cent. would be all that would return; on the other hand, I have occasionally found in some of the difficult cases that as high as thirty per cent. have returned. A better understanding of the technic of the operation has, however, reduced very markedly this percentage.

In some cases new hairs will begin to make their appearance in a few days from the time you begin to remove the hairs. You know these are not returns. Upon questioning the patient you will find that a week or ten days previous to the time she consulted you she had stopped removing the hairs, and now the returns from her daily use of the epilation forceps are beginning to appear. At once she will say that your operation is a failure and that the returns only show that she has been imposed upon. In cases of this kind the minute scar already described has served me a good turn; for getting the patient in a strong light and putting the skin upon the stretch, or reddening it by rubbing

or the use of electrolysis in the immediate neighborhood, I have been able to demonstrate to the patient by means of a hand-mirror the minute scars through which no hair appeared. Occasionally a hair would be found piercing one of these minute scars, and I could confidently state that that hair was a return, and could as positively state that the hair that was not surrounded at the surface of the skin with a whitish scar was not a return. The length of time required for the hair to return is from three to six weeks.

The electrolysis will frequently cause such destruction of tissues that when the lesion heals, the hair follicle will have entirely been closed up; and the hair growing from the papilla will gradually and by continuous pressure force its way through the layer of cells forming the cicatricial tissue and will establish a new follicle.

The tissues surrounding the hairs upon their reappearance are usually less dense than were the tissues which originally sur-

rounded it, and if the attempt at its removal be made soon after its reappearance the chances of success are decidedly greater than in the first instance.

SCARS.

It is a self-evident truth that cicatricial tissue will invariably replace that which was destroyed.

If the amount destroyed be microscopical, then will the scar itself be microscopical and not visible to the naked eye. The minute scars above described can almost invariably be made manifest by placing the skin upon the stretch in a good light, or by the use of some agent which will cause the skin to become erythematous, when they will appear like little white points in the reddened skin.

In one case in which the patient's skin was already pigmented and of a brownish color, the site of each hair was marked by a white scar which remained permanent and prominent because of the deep brown discoloration of the skin. In another case the electrolysis

was followed by the appearance of a reddish brown spot which remained for some six months before it eventually faded out and became of similar color to the surrounding skin, but these are exceptional cases.

In large pigmented and hair moles it is not of so much advantage to use care in the preventing of a scar, because the scars themselves will after a time become white and thereby diminish the appearance of the brown discoloration, especially when the patient is a few feet distant.

At this point I desire to emphasize the fact that it is always better, when you find from the appearance about the needle that the lesion is getting of such size as to leave a possible scar, to stop the electrolysis. My practice is to remove the hair, allow the lesion to heal, and when the hair returns attempt its removal again.

It is self-evident that a hair can eventually be removed, but a scar cannot be removed. In some of my earlier cases where these precautions were not always observed more of a

scar resulted than would in the same cases to-day; and occasionally even with the greatest of care the face will be pitted; this, however, is most likely to occur when the amount of destroyed tissue is of considerable size.

One of my cases who insisted on having a slight growth on the upper lip removed, found it somewhat inconvenient to come to my office and incidently mentioned to her family physician what she was having done; he at once volunteered his services, and some three months later the lady again came to my office with two or three well-marked pits upon her upper lip. When I asked in surprise if that had resulted from my treatment she at once told me the facts as above stated. In this case it was all but impossible to see where I had used the needle, even though the patient were placed in a strong light, and a magnifying glass used; while the scars resulting from the operation performed by the family physician were visible at least five feet from the patient. I had as effectually removed the hairs without scarring as

had the family physician who left the indelible prints of the operation on the young lady's face to testify as to his amateurness.

Allowing the eschar to remain as long as possible, and coating the surface by oxide of zinc ointment or some other substance which serves as a protective is advised, because when these precautions are used there is much less danger of pitting taking place. Court plaster would serve equally well were it not almost impossible to have it satisfactorily applied. In many cases the lesion will have disappeared within three or four days, while a week or ten days may be required for others.

THE NUMBER OF CELLS.

The number of cells I have found requisite in these cases rarely if ever exceeds ten, and frequently I make use of only four or five, as with care I find this number furnishes me sufficient electricity to destroy the papilla with the minimum amount of destruction to the surrounding tissues. Ordinarily the

current from this number of cells causes little or no pain. The tendency of operators is to use the current furnished from a larger number of cells (from ten to twenty). The difficulties encountered when this strength of current is used are such that unless great care is taken indelible scars will result, and the patient will be subjected to pain which will be almost unbearable. As a matter of course, when the larger number of cells is used the evidences of electrolysis are more strongly marked and the work is performed more rapidly; but as the work to be accomplished lies beneath rather than on the surface of the skin, it is essential that the surface manifestations should not be more than is evidenced by the small bubbles that appear by the side of the needle. It is always the safer plan to commence with a few cells and gradually increase their number until the desired point is reached rather than reverse this mode of procedure.

In this operation the milliammeter is almost if not quite useless. The operator must

watch the point at which electrolysis is taking place and be governed thereby rather than watch the index of his ammeter. In epilation the eye and hand must work in unison if the greatest success is to be obtained.

TIME CONSUMED IN, AND FREQUENCY OF, TREATMENT.

Ordinarily I have found that a treatment of half an hour is sufficient for both the physician and the patient. While I have been able occasionally to work two or two and a half hours on a single case at one sitting, I have observed that in the latter part of the treatment the work has not been as satisfactorily done as it was when both patient and operator were less fatigued. While the patients will declare that they are not tired and are willing to go on with the operation, yet as a general rule it will be found that a half hour's treatment is a tax upon their endurance which, if followed day after day, causes them at last to become excessively nervous, and, in some cases, I have found it

advisable to stop all treatment for several days. Occasionally I have had patients who complained of feeling much more weak and and debilitated the day following the operation than on the day on which it was performed.

ANÆSTHETIC ACTION OF THE CURRENT.

That the current produces a certain amount of local anæsthesia around the point of electrolysis, especially around the negative needle, we offer as evidence that the second introduction of the needle is almost painless; and frequently when the patient winced during the continuance of the current after the introduction of the needle the first time, the pain produced by the current after the second insertion is scarcely noticeable.

If the needle be allowed to glide down the hair follicle withous piercing the walls of the follicle, unless possibly at its very depth, the operation is much less painful than as though the needle pierced the skin at or near some of the papillæ. The reason of this is readily seen when we understand

that the terminal nerves of sensation are situated in the papillæ of the skin and consequently not far from the surface, and the walls of the follicle are almost dry, thereby serving as an insulator and preventing the current reaching the more sensitive nerve filaments.

Sometimes I have abandoned the attempt of the removal of a hair because I had succeeded in piercing the skin by the side of the hair and causing pain more than would have been caused had the skin not been pierced. At some subsequent time after the slight lesion produced had healed I have succeeded in reaching the papilla of such a hair and this with the same strength of current, but almost without pain to the patient.

DOES ELECTRICITY STIMULATE THE GROWTH OF THE HAIR?

This is a question that is occasionally asked by patients, and has repeatedly been asked by physicians. In the majority of cases the question may be answered in the

negative, while there remain a few cases in which the question is unanswered. Reviewing the cases that have come under my observation I find that they may be divided into several classes according to the growth of the hair.

One class has a distinct growth of large hairs upon a definite portion of the face (chin or lip) with no gradation from these large hairs to the fine lanugo hairs so usually found upon faces. The removal of these large hairs permanently cures the case, and there seems to be no tendency of any of the fine hairs to return. In this class of cases the question is emphatically answered, No.

In another class the hairy growth varies from the long, thin lanugo hairs to the thick, heavy hairs usually found in the beard. When the very heavy and medium hairs have been removed, a few of the lanugo hairs take on an increased growth, as probably they would have done had not any hair been removed by means of electrolysis.

In another class of cases the hairy growth

is just commencing and very closely resembles that upon the face of a young man on which the hairy growth is beginning to appear. In these cases there is a tendency which may persist for some time, and after the larger hairs are removed the finer hairs take on growth as in the former case.

In the last two cases, while we cannot answer the question with the decided No that we did in the first instance, we can at least state that in all probability the electric current does not stimulate the growth any more than would any other means which would increase the flow of blood to the part temporarily.

In many of these cases that I have had under observation for some time, I find that the tendency to hairy growth gradually disappears, and eventually the patient ceases coming to my office, because there is no necessity for her to do so. My personal opinion is that the hairy growth is but very slightly stimulated by means of electrolysis, and that it need not enter as a factor into the case at all.

CHAPTER V.

PORT-WINE MARKS, MOLES AND OTHER FACIAL BLEMISHES.

Besides superfluous hair, there are other facial blemishes, both congenital and acquired, that at times so disfigure the face as to constitute a sad deformity and render the possessor a recluse from society. These disfigurements may be with or without hairy growths.

Chief among these blemishes are the *pigmentary naevi,* which include pigmented spots not elevated above the surface of the skin, pigmented moles which form distinct elevations and contain an excess of fibrous tissue, pigmented areas not elevated above the surface, containing an abundant hairy growth; *moles* (fibromata) with or without pigment or hairs, wart-like moles (nævus verrucosus), and warts (papillomata), which latter, while

they are not included among nævi, will be considered with moles, for their treatment is essentially the same. *Vascular naevi*, which include, the simplest of all, the port-wine mark (nævus vasculosus simplex); than that form in which the blood-vessels are dilated to such an extent that there is scarcely any other tissue present but enlarged blood-vessels (angioma cavernosum); also the variety in which the capillaries are dilated and give to the skin of the part a bright red or purplish hue (telangiectasis); and closely allied to this is the variety known as nævus araneous, from its resemblance in form to the spider's web. Another of these blemishes is the yellow pigmented spots or plates found on the eyelids (xanthoma). Last of all we have acne and rosacea.

Before taking up these blemishes in detail let us consider, in a general way, some of the things that electrolysis will accomplish. As in the case of every other surgical procedure, there are certain things that can be accomplished by electrolysis better than by any

other known means; in other cases it accomplishes its results no better than will something else; and finally, while it may be used to accomplish certain results it does so in such an indifferent manner that some other means in the hands of the operator would have secured more perfect results with much less pain to the patient and with a corresponding saving of time.

These questions are constantly arising: Can this or that surgical procedure be accomplished by means of electrolysis? How is the physician to judge of the advisability of the employment of electrolysis? Without attempting to answer this in its broadest sense, but confining ourselves to the subject of facial blemishes, we can say that wherever a point-like cautery or multiple points of cauterization are required electrolysis is the method to be used. If, however, there is necessity of destroying tissue of more than one-third of an inch in diameter at one sitting, then the surgeon has at his command as good if not better means than electrolysis.

To repeat that which has been said several times before in this work—electrolysis is to the surgeon but a means of cauterization by means of acid or alkaline caustics, as he may elect. The amount of caustic liberated and consequently the amount of tissue destroyed depends on the surface of the needle in contact with the tissues, the amperage of the current and the time consumed in the operation.

The pain attendant on this operation may be stated in general terms to depend upon the amperage of the current. When a large surface is to be operated on the pain is ordinarily so great as to preclude the use of electrolysis unless an anæsthetic be given.

PIGMENTARY NÆVI.

Pigmented areas without elevation may be removed by means of electrolysis in one of two methods. First, the area may be blistered and the epidermis removed, after which the pigmentary layer may be removed by the application of a blunt-pointed electrode or a

loop of silver wire held in the needle-holder. The negative pole should be the one used in this case. Second, the surface may be tattooed with a sharp-pointed needle connected with the negative pole. In the first case, if the work has been thoroughly done, the whole of the pigmented area will have been removed and a superficial scar is the result. In the second case there will be a series of point-like scars, each one of which will be surrounded in whole or in part with a pigmented ring.

Fibromata, Papillomata. — All growths slightly elevated above the surface of the skin and of limited area may be included in this class, for their removal by electrolysis is accomplished in a similar manner, and one description will answer for all. A sharp-pointed needle connected with the negative pole is made to transfix the growth at its base on a level with the skin, and the current is allowed to pass until the appearance about the needle indicates that the destruction of the tissue is as much as is desired, when the

needle is removed and again introduced so as to pass through the base either parallel to the tract already acted on or at right angles to it. This should be repeated until the tissue composing the base of the growth has been completely destroyed, or until the nutrient supply to the growth has been cut off. During the electrolysis the growth will become whitened, and if without pigment will come to look very like a pearl. If the skin is thin and without pigment and the growth not too dense, the operator may see little bubbles of hydrogen gas appear in the tissues under the skin and observe the growth increase in size. The skin about the base becomes erythematous, and the appearance soon after the operation is very much like that period of vaccina so graphically described in the older works as "a pearl on a rose-leaf." Within a few hours this pearly look disappears and the growth assumes a brownish appearance, gradually drying down and forming a brown eschar. After a few days this eschar drops off leaving a surface on a level with the skin.

The ease with which these growths are destroyed varies so in different persons that it is frequently difficult to determine the length of time that the electrolysis should be employed. When these growths are situated on a prominent part of the face it will be found advisable in many instances to stop the operation at the earliest moment when in the judgment of the operator the growth *may* have been destroyed, even though the needle should subsequently have to be used a second or third time. The point to be ever kept before the operator is not to employ electrolysis longer than is absolutely necessary, lest an unsightly scar result.

A year ago I had as a patient a little girl who had a wart on the tip of her nose. I succeeded in removing it so that there was left but a slight scar. Six months after the last trace of the wart had disappeared she came to my office, the wart having returned. This was subsequently removed. Some fourteen years ago I removed twelve warts from the hands of a young lady at two sittings.

So thoroughly had the work been accomplished that there had been no returns some months later. I mention these cases to show that two cases with the same lesion may behave very differently to the same agent employed for their removal.

The needle to be used in these cases should always be sharp-pointed and flat, varying in size from the smaller-sized surgeon's needle to the broad lance-shaped needle for electrolysis, the situation of the growth as well as its size determining the size of the needle to be used. I have at times used to advantage the blade of my tenetome or abscess knife, first having connected it with the negative pole of the battery.

The size of the battery and the number of cells to be used is of great importance in these cases. The battery which will be all-sufficient for epilation may be wholly inadequate in removing large warts and moles. Ordinarily the zinc-carbon cell with bichromate of potassium and sulphuric acid as the exciting fluid furnishes sufficient amperage

and voltage if from ten to fifteen cells are used.

Whenever hairs complicate these growths the hair should be permanently removed before attempting the removal of the growth. It often occurs that when the offending hairs have been removed that the trouble has been so nearly overcome that little else is required to complete the operation. In one of my cases in which there was a pigmented mole (one inch long by half an inch wide) not elevated above the surface of the skin but crowded with hairs, I found that when the hairs, which were difficult of removal, had been effectually destroyed that the point-like scars which so thickly studded the growth had so changed its appearance that at the distance of a few feet the blemish was scarcely noticeable.

Whenever hairs grow in moles they are as a rule very strong, and the root is situated deep in the subcutaneous fibrous tissue. In the removal of these hairs it is not so essential to use care not to scar, for after the

removal of the hair the growth must be removed to complete the work. In many cases of small moles the removal of the hair has been found sufficient to cause the disappearance of the blemish.

It is not always that electrolysis is the best agent to use in the removal of moles, but like all other agents that are potent for evil or good the operator must be governed by experience.

VASCULAR NÆVI.

Nævus vasculosus simplex (*port wine marks*). Until within a few years these marks have been considered almost without remedy, but now we possess at least three distinct methods whereby this deformity may be greatly benefited if not wholly removed. These methods are: Linear scarification tangential to the surface, as recommended by Mr. Balmanno Squire, of London; tattooing by means of a number of needles so fixed that their points are on a level with and equi-distant from each other and charged by

being dipped into some irritating or caustic substance, such as croton oil, carbolic acid, or a solution of chromic acid, as recommended by DeSmet and Sherwell; and electrolysis as recommended by Drs. G. H. Fox and W. A. Hardaway.

The object is accomplished by these various means in essentially the same manner, viz.: —by producing a certain number of equidistant scars not large enough to disfigure, but sufficient in number and extent to diminish the color of the mark so that it ceases to be as much a disfigurement as before the operation. The destruction of tissue which results in producing the scars destroys as well the capillary network upon which this mark depends.

The underlying principle when we employ electrolysis is the same that makes this process so successful in the removal of superfluous hair.

The needles, whether they be single or multiple, should be sharp pointed and so ground that they will readily pierce the skin.

The size of the needle is not of so great importance as in the removal of hairs. On this point each operator will soon determine for himself which is the size best suited for any particular case.

The instrument used by Dr. Geo. H. Fox consists of a small brass disc which carries from four to twenty needles whose points are in the same plane and about two millimeters (one-twelfth of an inch) apart. This disc is screwed into a holder somewhat similar to the needle-holder described in Chap. III. A sliding sleeve of brass or rubber may be added to advantage. It will protect the needles when not in use and may be set so that when in use the needles will penetrate the tissues to but a certain depth.

Dr. H. G. Piffard recommends that a Carroll's vaccinator with six points be used.

When a single needle or several needles so fastened that their shafts are in the same plane as in Carroll's vaccinator are used, they may be introduced either perpendicularly or in a slanting (tangential) direction to the

surface of the skin. When Fox's holder is used the needles of necessity have to be introduced perpendicularly.

As in the removal of superfluous hair, the negative pole is the one to be connected with the needle or needles. The positive pole may be held by the patient, or, as is preferable in these cases, it is applied to the surface of the skin in the immediate neighborhood of the nævus.

The multiple needles are only applicable where the surface is level; about the mouth, nose or eyes the single needle should be used exclusively.

The current from a ten or fifteen cell zinc-carbon or an equivalent current from some other battery should be the one employed. After the needles are introduced the circuit should be completed either by having the patient press upon the sponge or by the application of the positive pole to the skin near the needle. The current should be continued for from ten to thirty seconds according to the peculiarities of the case,

dependent on the thickness of the skin, the amount of water it contains, etc. The appearance of the skin about the needle serves as an admirable index and is the point to be watched.

The healing of the lesion is essentially the same as that described as following the removal of hair. The whitening of the skin soon disappears because of the escape of the hydrogen gas on which this blanching was dependent. The skin remains red for some time provided the electrolysis was done so near the edge of the mark that the color of the mark does not obscure the above described redness. After a day or two the seat of each needle puncture is marked by a brownish eschar which at times may be slightly beneath the surface. The lesion heals within a few days, but it takes from three weeks to a month for the scar tissue to manifest itself sufficiently to testify to the efficacy of the operation. It may be necessary to repeat the operation several times before a satisfactory result is attained, but when at last we

have done all that we can for the case we will find that on close inspection there are a multitude of point-like scars which are so small as really to cause no disfigurement. In certain instances the deeper plexus of blood-vessels may be dilated so that they show through the superficial layers of the skin; they also may have been so deeply situated as not to have been reached by the needles in the beginning, and now have to be destroyed by inserting a fine sharp needle deep into the subcutaneous tissue.

The results of the operation do not remove entirely the blemish nor is the skin left in a smooth and perfectly normal condition, nevertheless the results are such that the unfortunate possessor of the nævus is not nearly as conspicuous as before the operation.

This operation is not without its disadvantages, chief among which are its painfulness, and the length of time required, and consequently it is not applicable in the case of children. The time for any one application is not great, but the time consumed in

waiting for the lesion of electrolysis to heal before a new treatment and the period that must intervene before the scar tissue has passed through the various changes before the final and unchanging period has been reached requires months to elapse between the instituting of the operation and its completion.

Angioma Cavernosum.—This variety of vascular nævi characterized by more or less elevation above the surface and of blood-vessels of much larger caliber than in the variety just described, may remain stationary, retrograde or increase in size. In those cases where the growth is encroaching upon the surrounding normal tissue by increasing in size, or in case it is so situated that it is subject to friction or pressure of such a nature to cause it to ulcerate and in consequence be liable to severe if not dangerous hæmorrhage, destruction of the growth is imperatively demanded. The question at once arises, can this be successfully accomplished by electrolysis? and if not in all cases,

in what cases then is it applicable and advisable to employ this means? Here the judgment of the physician and his past experience are required to determine whether, if he attempt electrolysis, he may not have to abandon the operation for one more radical and thus inflict additional pain and prolong the treatment unnecessarily. As a rule electrolysis should not be attempted if the nævus is more than a half inch in diameter, and then only when it approximates that size, if the growth is not rapidly increasing. Young children should not as a rule be made to suffer the pain attendant on electrolysis. In rapidly growing nævi I have seen the dilating blood-vessels rapidly encroach upon the cicatricial tissue so that when the lesion of electrolysis had healed very little improvement could be noticed. Some time since I was tendered a case provided I would state positively that I could remove the growth by means of electrolysis. A surgeon had attempted its removal a short time previously and with so little success that the patient had almost

abandoned the thought of having anything done. I declined the case with thanks, for it was one wholly unsuited for this operation.

Given a suitable case for electrolysis, how are we to proceed? The authorities are somewhat divided as to the best method. One recommends that the needle be connected with the negative pole, another states that the positive pole is the one to use, and still others make use of two or more needles so arranged that a portion of them are positive and the rest negative.

The number of needles used and the poles they are connected with will depend upon the situation, size and growth of the nævus, as well as on the experience of the operator.

The size of the battery as well as the number of cells will depend upon the size of the needles and their number, the resistance of the tissues between the poles, and the time consumed in the operation. From ten to twenty of the zinc-carbon cells will ordinarily suffice.

If the needle is to be connected with the

positive pole it should be composed of some metal, as irido-platinum, that is not corroded to any appreciable extent. It has been suggested that in these cases the steel needle would not be objectionable because the salts of iron formed would aid materially the effects of electrolysis.

When the positive pole is employed the needle becomes fixed in the tissues by reason of the coagulation of the albumens of the tissues and is consequently difficult of removal. In this case it would be well to reverse the current for a short time before removing the needle, as the hydrogen and the alkalies will loosen it and make its removal easy. This operation is no more applicable in the case of children than is that for the removal of the wine-mark and for the same reason.

Telangiectasis, Dilatation of Cutaneous Capillaries.—In this class we will include all acquired dilatation of the capillaries of cutaneous surfaces that are not congenital, the dilatation of the capillaries in the second stage of rosacea, and that form of nævus

known as nævus araneous, consisting of a central enlarged vessel with smaller ones radiating from this as a center after the form of a spider's web.

Except the removal of superfluous hair, there is probably no other form of blemish in which the use of electrolysis is so efficacious.

In every respect the operation is the same as in the removal of hair, except that the needle while being thin is sharp-pointed and does not have its temper drawn. It is introduced in such a manner as to enter the enlarged vessel and traverse it for a short distance. The current is now allowed to pass and the vessel is destroyed by the disintegration of the tissue and the consequent inflammatory processes. If you have chosen the larger trunk, as for instance the central vessel in the araneous variety, a single application may do all that is required. In certain cases I have seen the blood leave the vessel beyond the point of operation and the course of the vessel became blanched, and on closer inspec-

tion at times, using a magnifying glass, I have seen bubbles of hydrogen gas in the capillaries.

Either the negative or positive poles are sufficient to cause the destruction of tissue on which the success of this operation depends. In case the positive is used the same precautions that have already been given should be observed.

XANTHOMA.

This blemish consists of a yellow coloration in the form of a plate or lamina usually situated on the upper eyelid near the inner canthus. One or both eyes may be affected and the lower lid may sometimes be implicated. When this is the case the yellow color is not as bright and is not as extensive in area as when situated on the upper lid. This trouble is apt to be found in patients who are subject to hepatic derangement, are of sallow complexion and have dark lines under their eyes. Almost without exception the patients who have applied to

me for relief from this disfigurement have been women who have passed, or are about to pass, the change of life.

Excision is the usual means employed to remove the blemish, but many patients would much prefer to have ihe disfigurement than to submit to this operation about the eye. Up to the present time my experience has been with the knife or scissors, but from the testimony of others and my knowledge of what can be accomplished by means of electrolysis, I should not hesitate to employ this agent and would do so in full confidence that success would attend my efforts.

ACNE AND ROSACEA.

In these affections true electrolysis is not used unless, as already mentioned, in the second stage of rosacea, when the capillaries have become dilated. The galvanic current has been found to be of great value in the treatment of these diseases in certain stages. The galvanic current acts on these affections both by its local effect on the diseased part,

and also by reason of its action on the nerves of vegetative life, thus altering the nutrition of the parts, and finally by changing or arresting the reflexes on which these diseases are so frequently dependent. In advocating the use of electricity in these troubles it is not to be understood that it is the sole means to be used in the case, nor is it to take the place of some of the tried and efficacious means whose use is described in our works on diseases of the skin.

In acne the time for the use of this agent is not at the beginning of the treatment when the face has a large number of comedones, superficial papules, or deeper collections of pus, but after the proper chemical and mechanical means have been used, and we desire to improve the nutrition of the skin, to remove the products of inflammation and impart tone to the blood-vessels of the skin do we find the place for the employment of electricity.

There are two or three methods of employing electricity for acne. One authority rec-

ommends the bipolar, another the unipolar method, while still another recommends in connection with either one or other of these methods that central galvanization be employed.

The bipolar method consists in applying the two poles in close proximity to each other on the face. The electrodes are covered with sponges or some other material that will absorb moisture and are moistened before applying them to the face. The electrodes are moved from place to place on the face until the surface is generally reddened. In some instances the negative pole is not covered, and the metal of which it is composed is brought in contact with the skin. In place of two electrodes one authority (Piffard) makes use of a double-roller double-current electrode. The strength of the current should be as strong as can be conveniently borne, and strong enough to make the face decidedly red.

In the unipolar method one electrode is applied to the nape of the neck or on some

distal portion of the body, while the other electrode is applied to the face. When this process is used the strength of the current must be more gradually augmented because of the danger of the patient becoming dizzy or even being nauseated.

Central galvanization is preformed by placing one (usually the negative) electrode over the solar plexus on the abdomen and applying the other on the forehead, and then with an augmented current this electrode is carried on either side of the spinal column from the upper cervical to the sacral region.

When the bipolar method is the one used the effects of the current are local. When the unipolar method is used there is added to this local effect an effect due to the electrical stimulation of the nerves which receive the greatest stimulation when central galvanization is used.

After this treatment the face is very much reddened, and after several hours this gives place to a more blanched appearance than it had previous to the operation. The treatment

should be repeated three times a week until the tendency of the acne to reappear has passed away. The application should continue for from five to fifteen minutes. This will be governed by the amount of redness produced and the strength of the current, etc.

In rosacea the electrolytic needle may be used to destroy the dilated capillaries as already described, and the galvanic current may be used as in acne to overcome the erythematous and nodular condition so often found about the nose and adjacent parts of the cheeks.

Good results have been reported from the use of the faradic current in cases of acne and rosacea, but as my experience has been with galvanism and my results have been all that I could desire, I have not essayed the use of faradism.

DOSAGE.

I have studiously avoided mention of the current strength in milliamperes for the following reasons: First the milliammeter is a

comparatively new instrument and is not generally in the hands of the profession. Second, the changes which take place about the needle give undisputed evidence which indicates in each special case the strength of the current to be used and the length of time it should be continued. Third, by reason of the changes just mentioned the operator should watch the point of operation and not the ammeter, even though it were possible for him to notice both at the same time. Fourth, the small amperage used would add to the difficulty of reading the indications in many of the instruments on the market.

I cannot close without again emphasizing the fact that too often too strong a current is used, especially by those who are beginning the use of electrolysis in the treatment of facial blemishes. Remember that too strong a current may leave indelible marks behind, and that too weak a current may only necessitate your having to do a part of your work over again.

CHAPTER VI.

DON'TS.

IN REMOVING SUPERFLUOUS HAIR

Don't use a sharp-pointed needle.

Don't attach the needle to the positive pole.

Don't use too strong a current.

Don't continue the current long enough to leave a visible scar.

Don't remove two hairs in close proximity to each other.

Don't attempt the removal of a hair near an acne pustule.

IN REMOVING OTHER FACIAL BLEMISHES BY MEANS OF ELECTROLYSIS

Don't use a blunt-pointed needle.

Don't use too weak a current.

Don't attempt the removal by electrolysis of a rapidly growing vascular nævus of more than one-third of an inch in diameter.

Don't attempt the cure of acne or rosacea by electricity only.

IN GENERAL

Don't attempt to use the faradic current for electrolysis.

Don't use a steel needle with the positive pole.

Don't have the cords too short.

Don't make and break the current in metallic circuit.

Don't have poor connections between the electrodes and the battery.

Don't allow the patient to remove the eschar.

Don't attempt electrolysis in young children.

Don't use electricity when some other agent will accomplish the result in a better manner.

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